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10/558,917	08/29/2006	Michael S. Wong	1789-12702	8501
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CONLEY ROSE, P.C.			JOHNSON, KEVIN M	
David A. Rose				
P. O. BOX 3267			ART UNIT	PAPER NUMBER
HOUSTON, TX 77253-3267			1793	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/558,917	Applicant(s) WONG ET AL.	
	Examiner KEVIN M. JOHNSON	Art Unit 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-12 and 19-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-12 and 19-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status

1. Claims 3, 8 and 9 are amended. New claims 29-35 are added. Claims 1-5, 7-12 and 19-35 are pending and presented for examination.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 8 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The claim requires that the organic-inorganic gel structure formed by the process described in claim 1, from which the instant claim depends, is an aerogel. However, claim 1 requires that the synthesis solution is dried in air at about room temperature and the guidance and direction provided in the instant specification indicates that drying in air at room temperature would produce a xerogel, not an aerogel as required by the claim (page 10, lines 12-17). The instant specification indicates that to produce an aerogel a supercritical drying process is required (page 10, lines 12-17). As a result of the disclosure of the instant specification, one of ordinary skill in the art at the time of the invention would not be expected to be able to produce an aerogel utilizing the process required by the instant claim.

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4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-5, 7-12 and 19-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. The term "clear" in claim 1 is a relative term which renders the claim indefinite. The term "clear" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It would not be immediately apparent to one of ordinary skill in the art at the time of the invention what constitutes a clear solution. The instant specification provides no guidance as to what is required for a solution to be considered clear. Is a certain light transmission level required, does clear preclude the solution from being colored? These and similar questions prevent one of ordinary skill in the art from determining the scope of the instant invention.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

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1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 1, 2, 4, 5, 9-12, 19, 21, 27, 29, 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. (Chem. Commun., 2001, pp. 1738-1739).

In regard to claims 1, 4 and 27, Hwang teaches a method for producing catalytically active porous thin films of TiO₂ (page 1739). The process comprises the steps of producing nanoparticles, adding a pore-forming agent to the solution that contains the nanoparticles and catalyst precursor, aging/drying the material at 18°C in a controlled humidity environment and calcining the dried material to produce a porous catalyst (page 1738). An organic-inorganic mesostructure is formed during the drying/aging process, and as this step is not taught to take place in an environment other than air it would be obvious to one of ordinary skill in the art at the time of the

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invention that the drying/aging took place in air (page 1738). The mesostructure is considered to be a gel structure. The film after calcination is taught to be transparent, and therefore it would have been obvious to one of ordinary skill in the art at the time of the invention that the precursor solution would be considered to be clear (page 1738). The nanoparticle precursor solution is not expressly disclosed to be an aqueous solution, but one of ordinary skill in the art would realize the precursor solution would be aqueous because the solution is taught to comprise water in an amount far in excess of any other solvents (page 1728). It is well established that any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results (MPEP 2144.04 IV C).

In regard to claims 2 and 29, the catalyst precursor employed in the process disclosed by Hwang is titanium chloride (page 1738).

In regard to claims 5 and 19, Hwang teaches that the nanoparticles are TiO_2 (page 1738).

In regard to claim 9, the mesoporous films do not contain crystalline TiO_2 (page 1739). Hwang teaches that the nanoparticles have sizes of 1.6-2 nm and that the final wall thickness of the material is 3 nm, indicating that after the drying and calcination of the product results in the deposition of additional material on the nanoparticles (page 1739). It would have been obvious to one of ordinary skill in the art at the time of the invention that the additional material present on the nanoparticles would constitute an additional catalytic component layer. The additional material is TiO_2 deposited on the particles as the gel is dried and the solvent is removed from the mesostructure.

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In regard to claim 10, Hwang fails to expressly teach that a catalytic component layer exists on the nanoparticles in the material with a surface density of at least 4 molecules per nm^2 . Hwang teaches that the nanoparticles have sizes of 1.6-2 nm and that the final wall thickness of the material is 3 nm, indicating that after the drying and calcination of the product results in the deposition of additional material on the nanoparticles (page 1739). It would have been obvious to one of ordinary skill in the art at the time of the invention that the additional material present on the nanoparticles would constitute an additional catalytic component layer with a surface density that meets the requirements of the instant claim. The additional material is TiO_2 deposited on the particles as the gel is dried and the solvent is removed from the mesostructure, and as there is no teaching or suggestion in Hwang that this layer would not be solid the surface density of the layer would clearly exceed 4 molecules per nm^2 as required by the instant claim.

In regard to claim 11, the mesoporous films disclosed by Hwang do not contain crystalline TiO_2 (page 1739).

In regard to claim 12, Hwang fails to expressly teach that the catalytic precursor is polymerized. One of ordinary skill in the art at the time of the invention would expect that at least a portion of the catalytic precursor utilized in Hwang is polymerized. The process conditions utilized by Hwang in conjunction with the ethylene oxide diblock copolymer present in the solution would be expected to result in at least a minimal amount of the catalytic precursor being polymerized.

In regard to claim 21, the pore-forming agent employed in the process taught by Hwang is an ethylene oxide diblock copolymer (page 1738).

In regard to claim 30, Hwang teaches a method for producing catalytically active porous thin films of TiO₂ (page 1739). The process comprises the steps of adding a pore-forming agent to a solution that contains nanoparticles and a catalyst precursor, aging/drying the material at 18°C in a controlled humidity environment and calcining the dried material to produce a porous catalyst (page 1738). The nanoparticles disclosed by Hwang have sizes of 1.6-2.0 nm (page 1739). An organic-inorganic mesostructure is formed during the drying/aging process, and this mesostructure is considered to be a gel structure. It is well established that any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results (MPEP 2144.04 IV C).

In regard to claim 32, the process disclosed by Hwang is not taught to include precipitation.

11. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang as applied to claim 1 above, and further in view of Wong et al. (Nano Letters, 2001, Vol.1, No. 11, p 637-642).

In regard to claims 22 and 23, the pore-forming agent employed in the process taught by Hwang is an ethylene oxide diblock copolymer (page 1738). Hwang fails to teach the use of an EO-PO-EO triblock copolymer as the pore-forming agent.

Wong teaches a similar process for forming a mesoporous material from a synthesis solution containing nanoparticles. A nonionic poly(ethylene oxide)-

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poly(polypropylene oxide)-poly(ethylene oxide) triblock copolymer of the form $\text{EO}_{20}\text{PO}_{70}\text{EO}_{20}$ is disclosed as the preferred pore-forming agent (page 638).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the pore-forming agent disclosed by Wong in the process disclosed by Hwang. Such a modification would have been motivated by the teaching in Hwang of ethylene oxide block copolymers as the pore-forming agents and the teaching in Wong that $\text{EO}_{20}\text{PO}_{70}\text{EO}_{20}$ triblock copolymers are especially useful in a similar process for producing mesoporous materials from nanoparticle containing solutions.

12. Claims 3, 31 and 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang as applied to claims 1 and 30 above, and further in view of Ying et al. (US 5958367).

In regard to claims 3 and 31, Hwang fails to teach the use of an anionic or zwitterionic surfactant as the pore-forming agent.

Ying teaches that anionic surfactants may be utilized as pore-forming agents in the production of porous titanium oxide materials (column 23, line 44 – column 24, line 2).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize an anionic surfactant in the process disclosed by Hwang. Such a modification would have been motivated by the teaching in Ying that anionic surfactants are especially useful for the production of porous titanium oxide materials.

In regard to claims 33 and 35, Hwang teaches a method for producing catalytically active porous thin films of TiO_2 (page 1739). The process comprises the

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steps of adding a pore-forming agent to a solution that contains nanoparticles and a metal salt as a catalyst precursor, aging/drying the material at 18°C in a controlled humidity environment and calcining the dried material to produce a porous catalyst (page 1738). An organic-inorganic mesostructure is formed during the drying/aging process, and this mesostructure is considered to be a gel structure. It is well established that any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results (MPEP 2144.04 IV C). Hwang fails to teach that an anionic surfactant is utilized in the process.

Ying teaches that anionic surfactants may be utilized as pore-forming agents in the production of porous titanium oxide materials (column 23, line 44 – column 24, line 2).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize an anionic surfactant in the process disclosed by Hwang. Such a modification would have been motivated by the teaching in Ying that anionic surfactants are especially useful for the production of porous titanium oxide materials.

In regard to claim 34, the nanoparticles disclosed by Hwang have sizes of 1.6-2.0 nm (page 1739).

13. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang as applied to claim 1 above, and further in view of Wong and Brinker et al. (Adv. Mater. 1999, 11, No. 7, p 579-585).

In regard to claim 24, Hwang fails to teach that one of the pore-forming agents required by the instant claim is utilized in the process.

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Wong teaches that the nonionic surfactants associate with the H⁺ ion in acidic solutions, and therefore act in a manner similar to cationic surfactants (column 2, p 640).

Brinker teaches the use of the cationic surfactant cetyltrimethylammonium bromide (CTAB) as a pore-forming and structure directing agent (column 2, p 580).

It would have been obvious to one skilled in the art at the time of the invention to substitute CTAB for the pore-forming agent utilized by Hwang. Such a modification would have been motivated by the teaching in Brinker that CTAB is a known structure directing agent, and the teaching in Wong that in acidic solutions, such as the solution disclosed by Hwang, nonionic surfactants associate with the H⁺ ion in acidic solutions, and therefore act in a manner similar to cationic surfactants.

14. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang as applied to claim 1 above, and further in view of Winter (US 3907921).

In regard to claim 28, Hwang fails to teach that the porous catalyst is impregnated with an additional catalyst precursor or non-surfactant polymer.

Winter teaches that it is well known in the art to impregnate porous materials with catalyst precursors to improve the catalytic function of the porous material (column 3, lines 46-58).

It would have been obvious to one skilled in the art at the time of the invention to impregnate the porous material disclosed by Hwang with a catalyst precursor. This modification would have been motivated by the teaching in Winter that it is well known

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in the art that impregnating catalyst precursors in to porous materials improves the catalytic performance of the material (column 3, lines 46-58).

Allowable Subject Matter

15. Claims 7, 20, 25 and 26 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

There is no motivation to modify the process disclosed by Hwang to include a first catalytic precursor other than a titanium compound, as required by the instant claims.

Response to Arguments

16. Applicant's arguments, filed 3/31/2009, with respect to the rejection(s) of claim(s) 1-5, 7-12 and 19-28 under USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the newly found prior art Hwang.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEVIN M. JOHNSON whose telephone number is (571)270-3584. The examiner can normally be reached on Monday-Friday 7:30 AM to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerry Lorengo can be reached on 571-272-1233. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner, Art Unit 1793

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